Changes in HIV/AIDS Knowledge And Testing Behavior In Africa: How Much and for Whom?

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ABSTRACT

Demographic and Health Survey data from six African countries indicate that HIV prevention knowledge is improving and that more Africans are getting tested. Still, in many cases fewer than half of adult respondents can identify specific prevention behaviors; knowledge appears particularly inadequate in countries not yet fully gripped by the epidemic. Schooling and wealth impacts on prevention knowledge generally have either not changed or have increased, meaning that initial disparities in knowledge by education and wealth levels have persisted or widened. HIV messages therefore need to be made more accessible to and/or better understood by the poor and less educated.

Keywords:
Africa, AIDS, Demographic and Health Surveys, reproductive health

I. INTRODUCTION

AIDS has had its most devastating impacts in Africa and the prevalence of the disease continues to rise in most countries on the continent. With a feasible vaccine still years away, reduction in risk behaviors remains the only way to reverse the epidemic. An obvious prerequisite for behavior change is that people have an understanding of the disease and how infection can be averted. Several studies have looked at the determinants of HIV risk behaviors in Africa (Filmer 1998, Blanc 2000), but analysis of the factors determining knowledge of means of HIV prevention is less common.[1]

Further, the studies that have been carried out to date have been cross sectional analyses.[2] In this paper in contrast we consider the all important issue of changes over time in HIV prevention knowledge as well as in HIV testing behavior and attitudes toward testing. We do this by taking advantage of the fact that there is now a significant number of African countries in which more than one round of Demographic and Health Surveys (DHSs) with comparable HIV-related information has been carried out. We examine changes in these outcomes in six countries-- Burkina Faso, Kenya, Nigeria, Tanzania, Uganda, and Zambia--over periods of 3 to 6 years during the mid to late 90s and early 00s, as dictated by the survey years. In addition we ask how changes in knowledge and testing behavior are distributed across the distributions of schooling and household income as well as by gender and rural vs. urban location. We address this question descriptively and econometrically, the latter by estimating and comparing statistically HIV knowledge 'returns' to schooling and wealth in early and later survey years.

The question is important for policy. For example, if the impact of schooling on the probability of knowing that condoms can prevent infection is found to have risen over time, this would indicate that public information campaigns have been more successful at reaching the better educated, or else at providing information that is more easily processed by them. It would signal a need to better target or tailor messages to those with less schooling. Similar considerations would apply to findings of an increasing gradient with respect to wealth, or to increasing or persistent rural-urban and gender gaps in HIV/AIDS knowledge.

This remainder of this paper is organized as follows. The next section discusses theoretical considerations that help to frame the analysis of the impacts of factors such as education and income on HIV knowledge and testing, and how these impacts may change over time as HIV knowledge spreads and public education efforts are intensified. Section 3 describes the DHS data we use. Section 4 presents results, starting with descriptive patterns and trends, followed by model results and comparisons of impacts of key

[1] Gersovitz (2001), Gwatkin and Deveshwar-Bahl (2001) Glick, Randriamamonjy and Sahn (2004) do consider HIV knowledge, though the first two are descriptive studies.

[2] Gersovitz (2001) is a partial exception in that he uses artificial cohort analysis from repeated cross sections to assess changes in some behaviors over time.

regressors across location (rural/urban), gender, and over time. Section 5 draws together the findings and concludes with a discussion of implications for policy.

II. CONCEPTUAL FRAMEWORK

As indicated, in addition to simply ascertaining from descriptive analysis whether and how HIV/AIDS knowledge has changed over time, we are interesting in determining whether the distribution of this knowledge has been constant across the distributions of income and of schooling in the population or instead whether prevention knowledge has increased more for some subpopulations than others. In other words, have the (presumably positive) 'returns' to schooling and wealth increased, decreased, or remained unchanged? Similarly, we are interested in whether and how the effects of these characteristics on testing behavior and attitudes have changed over time.

First, we note that there is a fairly long list of reasons to expect those who are better schooled or wealthier to have attained more awareness of HIV and how it can be prevented. Educated people are more likely to have access to many sources of health and HIV-related information: they are more likely to read the newspaper, or to visit private or public health services where HIV-related information is dispensed. If information comes through channels they already use, the marginal costs of obtaining HIV/AIDS information will be low for the well educated. Education may also make it easier for individuals to process and understand the information to which they have access. In other words, education and health information inputs may be complements in the production function for health knowledge (though the opposite may also occur: if messages are designed to be understood by the uneducated, schooling and health information may be substitutes). Further, as Becker (1993) has pointed out, those with more schooling have already made larger investments in the future. Since their future stream of earnings, hence consumption and utility, is higher, they have greater incentive to protect their health and insure their longevity by gathering or being attentive to information about HIV prevention. Greater investment in education may be a reflection of a lower discount rate, which again would incline those with an education to seek information and change behaviors to insure their longevity. Finally, at least in younger cohorts, those who went to or stayed in school may have been exposed to school-based HIV/AIDS programs.

Observed correlations of wealth or income and HIV knowledge may occur through the association of wealth and income with education. But even controlling for education, wealth should be correlated with access to HIV/AIDS information through, for example, ownership of a TV or radio or more frequent use of health care practitioners. Furthermore, the rate of time preference may be higher for poorer people (perhaps because their poverty lowers their life expectancy; see Lawrence 1991). If as a result the poor discount future consumption more heavily than the well-off, they would be expected to invest less time or money in gathering health information. We would expect also that healthiness is a normal good, hence the demand for information about health generally and HIV/AIDS specifically to rise with income. Finally, in Africa, higher income is

typically associated with having a larger number of sexual partners (Filmer 1998, Carael, 1995). Therefore high-income individuals, all things equal, are engaged in more risky behavior and may have greater potential benefits to both learning about HIV prevention and testing.[3] With respect to testing, we would expect the costs associated with getting tested, which can include non-trivial transportation costs in environments where local voluntary testing and counseling (VCT) services are rare, to discourage poorer individuals from using this service.

The foregoing explains why HIV knowledge, and possibly testing as well, should be increasing in the levels of education and income. These patterns (at least with respect to knowledge; testing outcomes have received less attention) are indeed typically found in empirical studies (Davidson R. Gwatkin et. al. 2001; Glick, Randriamamonjy and Sahn, 2004). More difficult is to derive predictions about how these differences in prevention knowledge (and in testing behavior and attitudes) across the schooling and income distributions may change over time. Consider first that the policy and social environment with respect to HIV/AIDS can change quickly, even over the 3-6 year periods separating survey rounds in our samples. Mobilization efforts and public information campaigns were expanding in each of our study countries, if to a greater or lesser degree. The flow of information about the disease through social networks would likely also have increased, in part through a multiplier effect of public education efforts. These developments would make it easier—less costly—for people to acquire this information. However, particularly for public mobilization efforts, the educated and uneducated may be differentially affected. As suggested already, information that is disseminated through health centers, schools, print media, television and possibly even radio are more likely to reach a better educated audience. This would lead to a strengthening of the association of HIV knowledge and education over time. If instead mobilization occurs through such mechanisms as community outreach programs and information sessions held at public gatherings such as weekly village markets, the cost of access to information may fall the most for less educated (and poorer) individuals.[4]

Level of education may determine not only access or exposure to the growing supply of HIV information, but also the effect of this information on actual HIV knowledge and attitudes toward testing. If schooling and HIV/AIDS-related information are complements in the production of HIV knowledge, the effect of schooling on knowledge will rise over time as the supply of this information increases. If instead HIV messages are substitutes for schooling, returns to schooling would fall over time, all things equal. For this reason as well, it is not possible to predict the nature of changes over time in the returns to schooling on HIV/AIDS knowledge (and behavior). Turning this around, however, estimates of how these returns have changed allow us to infer something about the nature of the spread of information about HIV, and implicitly about

[3] The word 'may' is important, since people who have long engaged in high risk behavior may feel strongly that they have already been infected, hence (unless they are altruistic and seek to prevent infecting others) see little benefit to testing or learning more about HIV prevention.

[4] Or, information eventually may become so widely disseminated that the cost of information is essentially driven to zero for everyone, which would eliminate any advantage in information access to being educated.

policies. For example, if an increase in mean HIV knowledge is accompanied by an increase in the impacts of education on knowledge, we can infer that mobilization policies during the period have either not been directed at channels that are accessed by those with little schooling, or the messages have not been effectively designed to be understood by them.

The impact of income or wealth on HIV knowledge may also shift over time, again depending on how information is disseminated at the margin. If dissemination occurs primarily through channels normally accessed by the well-off, the cost of information falls more for them than for the poor. To the extent that the new information comes through public policy, the benefits of this public spending are in effect 'captured' (in the sense of Lanjouw and Ravallion 1999) by the well-off. If instead information programs are set up to target the poor though the modalities noted above, they potentially will reduce income or wealth differentials in HIV/AIDS knowledge. With regard to testing, if VCT services are set up in areas or facilities more accessible to the economically advantaged, we would expect a rising impact of wealth on testing over time. On the other hand, the wealthy may initially have access to testing through private health services, in which case an expansion of free or subsidized public testing services can disproportionately increase testing by the less well-off.

Cross-sectional rural-urban differences in the effects of schooling and wealth can be also interpreted using this conceptual framework. Access to HIV/AIDS information is presumably scarcer, hence costlier, in rural areas. Where it is available, it may be transmitted through channels used disproportionately by better-educated as well as wealthier rural residents, such as health centers, newspapers, or radio. In urban areas information is probably more generally accessible: less educated or poor urban residents usually have greater access to health services than their rural counterparts, are probably more likely to know someone or someplace with a TV or radio, and may be more exposed to information simply because social networks are denser in cities and towns. This would tend to reduce the advantage to having more schooling or income in urban as compared with rural areas. For schooling, however, the nature of the production technology for health knowledge also comes into play. If education and information are complements in the production of HIV knowledge, education effects will tend to be larger in *urban* areas, where the supply of information is greater, all things equal. This will offset the rural-urban differential in schooling effects coming through the access pathway. If they are substitutes, the effect of education will be larger in rural areas, magnifying the differential caused by differences in access.

Finally, an important pattern in the data, discussed in more detail below, is that HIV knowledge is greater for men than women. Although differential schooling may explain some of this difference, men and women are also likely to differ in terms of how easy it is to obtain information about HIV/AIDS. Women probably have more exposure to the health care system through their use of child and maternity related services, but their social networks may be limited in terms of breadth relative to men: they may be less likely to regularly travel away from home to urban areas, for example, and less likely to frequent certain places (such as bars) where HIV/AIDS discussions occur. Media

campaigns may affect women disproportionately by providing sources of information that are alternatives to those to which they lack access relative to men. Still, as in the previous cases, it is more difficult to form priors than to interpret results in light of plausible conceptual frameworks. With regard to gender and testing probabilities, women may be more fearful of testing than men (discussed further below) but also may be more likely to be exposed to opportunities to be tested through their use of reproductive health services.

III. DEMOGRAPHIC AND HEALTH SURVEYS

We use twelve Demographic and Health Survey (DHS) for this study – two each from a sample of six African countries. Funded by USAID and implemented by Macro International, Inc., the DHS are nationally representative surveys that have been carried out in more than 50 countries over the last two decades. In addition to standard household information, the DHS traditionally collects information on women of reproductive age (15-49), focusing on reproductive histories, health, and the nutritional status of young children. In recent waves (DHS II and III) the surveys were expanded to include (a nationally representative sample of) men as well. Since the early 1990s, special modules have been included on sexual knowledge and behavior that include questions related to HIV/AIDS. A great benefit of the DHS is that the questionnaires are standardized both across countries and over time, though some differences exist. This allows us to use a common set of independent variables and dependent variables, facilitating comparisons across countries, gender, region, and time.

Our selection of countries for this study was determined in part by the fact that each of these countries had two survey rounds at least a few years apart with the appropriate HIV/AIDS module. As shown in Table 1, the period between surveys ranges from three years in Tanzania to six years in Burkina Faso. The chronological year of the last survey ranges from 1999 to 2003. In addition, these countries capture at least some regional representation as well as variation in HIV prevalence and policy response. We include the Southern African country of Zambia, with exceptionally high but falling prevalence (estimated to be 22% in 2001, the year of our last survey, and 16.5% in 2003).[5] From East Africa we include Uganda (estimated prevalence of 5% in 2001, the last survey year, down sharply from a decade before), Kenya (7% in 2003) and Tanzania (8% in 1999, the year of our last survey, and 8.8% in 2003). From West Africa we include Burkina Faso (6% in 1999, 4.2% in 2003) and Nigeria (5.4% in 2003).

The analysis considers first, knowledge about behaviors that can reduce HIV risk. We consider (separately) whether an individual knows that the risk of infection can be reduced by the following: using condoms, limiting the number of sexual partners or having only one partner, and abstinence (avoiding sexual relations). In the surveys we use, the questions about risk prevention are posed in the same way. Respondents who

[5] Prevalence estimates are taken from UNAIDS reports, various years. We report data for the closest year available to the second DHS round used in each country.

say they have heard of HIV/AIDS are asked if there "is anything a person can do to avoid getting AIDS or the virus that causes AIDS," and those who respond affirmatively are asked "what can a person do?" The respondents are not prompted with possible answers. If the respondent can name a means of avoiding AIDS, the interviewer indicates the answer with the appropriate code and asks if the respondent knows any other means.[6] Note that the questions are worded in such a way as to be depersonalized, i.e., individuals are asked how can "a person" avoid AIDS, not "how can you avoid AIDS"; this encourages them to state their general knowledge of prevention rather than merely the behaviors that might be most relevant to their situations. We note, finally, that for convenience we will refer to the "limiting the number of sexual partners or having only one partner" response simply as "limit number of partners"; it should be kept in mind that in most surveys this corresponds to two possible responses: one for "be faithful to one partner" and one for "avoid multiple partners" or "limit the number of partners". As these responses communicate largely the same idea—and individuals who correctly identify one presumably would also understand the other—we group them together.[7]

We also consider questions about testing: whether the respondent says they have had an HIV test, and if not, whether they would like to be tested. In a subsequent paper we will focus on changes in behavior as reported in the DHS. For now we note that HIV knowledge and attitude questions (which describe all our dependent variables other than actual testing experience) are less likely to be subject to well known problems of mis- or under-reporting than are questions about sexual behaviors.

IV. EMPIRICAL APPROACH

For each of the binary dependent variables we estimate cluster fixed effects reduced form probits with an index function of the following form:

$$y_i = \beta X_i + \sum_{j=1}^{n-1} \alpha_i d_j + \varepsilon_i$$

where β is a vector of parameter estimates, X_i is a vector of characteristics of the ith observation. The d_j are a series of dummy indicators of the survey cluster (or community) and the α_j are the community fixed effects. These terms are included to control for the likely correlation of individual factors such as schooling or wealth with unobserved community level characteristics that also influence knowledge or testing. The community fixed effects specification eliminates bias in the estimates of included

[6] In some of the surveys, a "safe sex" is allowed as a response; the individual is then asked what she means by this, again without being prompted for answers.

[7] What is more important is that the questions be posed consistently over time. In three of our countries (Uganda, Kenya, Tanzania), the questions were essentially identical in both survey years. In Burkina Faso, Nigeria, and Zambia there were slight differences over time in the "limit partners" categorizations. We note these below when presenting our results.

regressors caused by any unobserved community level factors that enter linearly in the index function.[8]

The covariates we include are standard but we try to restrict the list to variables that can reasonably be regarded as exogenous to our outcome variables. Thus we exclude, for example, 'daily radio listening', since this both this and HIV knowledge may be jointly determined by unobservable preferences or abilities. To provide flexibility, years of education and age are each entered in quadratic form. The DHS does not contain information on consumption expenditures or household income. Instead we represent the level of household resources with an asset index derived using factor analysis, which has been found to be a good proxy for household expenditures (Sahn and Stifel 2003).[9] We also include a dummy variable to capture whether the individual respondent reported being in a stable relationship with a spouse or a cohabitating partner. Finally, we include years of partner's schooling (set to zero for those not in a partnership). Since partners may exchange information, one's partner's education may be a determinant of one's own HIV knowledge.

With regard to presentation, given the number of estimations it would be very cumbersome to show all our probit results. Instead we calculate marginal effects (the change in the probability of a 'successful' outcome from a unit change in the independent variable) for selected covariates—schooling, age, and the asset index. We also present results of statistical tests comparing these marginal effects across area (rural and urban), gender, and survey rounds.

V. RESULTS

V.1 Patterns and Trends in HIV Prevention Knowledge and Testing

HIV prevention knowledge

Table 1 shows the means of the binary prevention knowledge outcomes for each country and survey year by gender and location. It also shows, in the first pair of columns, the share of respondents indicating that they had heard of HIV/AIDS. With the notable exception of women in rural areas of our two West African Countries, virtually everyone in each subsample is aware of the disease, even for the earlier years. For rural Burkina Faso and Nigeria, the shares of women having heard of AIDS in the most recent surveys are 85% and 82%, respectively. Clearly, for the great majority of the population covered by these surveys, a lack of basic awareness of AIDS is not relevant as a constraint to knowing about prevention.

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[8] The results will not be unbiased if the unobservables enter non-linearly, that is, if they interact with included individual level covariates—for example, if the response to the presence of a local program to dispense HIV information depends on wealth or education. As the earlier discussion makes clear, this process cannot be ruled out and this should be kept in mind in evaluating the estimates.

[9] See Sahn and Stifel for a discussion of the method used to create this index.

The table indicates the share of individuals who identify each prevention behavior (use condom, avoid sexual relations, limit the number of partners) as well as the share that can identify at least one of the three. Note that these figures are not conditioned on knowing about AIDS; the (usually very few) respondents who have not heard of the disease are grouped with those who have but do not know about the given means of prevention. It is clear that prevention knowledge has been increasing in all countries, in some cases dramatically so. For example, the share of rural women age 15-45 who know that condoms can prevent HIV infection increased from 0.17 to 0.50 in Uganda between 1995 and 2001. The share of urban Tanzanian women reporting that abstinence can prevent HIV transmission increased from 0.18 to 0.35 in three years, from 1996 to 1999. Other changes have been less dramatic. In general, increases are larger for knowledge of condoms and abstinence than for knowledge of limiting the number of partners as a way to avoid AIDS. For Nigeria, and for men but not women in Zambia, the shares identifying limiting the number of partners as a prevention behavior actually appears to have declined over time.[10] To compare the rate of change across countries it is necessary to adjust for the differences in the periods covered. On an annualized basis (calculations not shown) it is apparent that knowledge has increased the fastest in Burkina Faso and Tanzania, and the slowest (indeed, if at all) in Nigeria.

If we consider the share of respondents that can identify at least one of the three prevention behaviors (last two columns), improvements over time are usually more modest. This indicates that some of the improvement in prevention knowledge has come from individuals becoming aware of additional approaches to preventing infection. Also, in some countries or regions (e.g., Zambia) the share is already very high so there is not a great deal of room for improvement in this measure.

With regard to levels rather than changes and considering the most recent year for each country, knowledge of HIV prevention methods (particularly condom use) seems highest in Uganda and Zambia (though for Uganda this is based on comparisons for women only since data on men were not collected) and lowest in Burkina Faso and–markedly–Nigeria. This ranking makes broad sense. Uganda has had perhaps the longest history of the disease and has also had possibly the most ambitious policy of AIDS education, and Zambia has the highest prevalence; both should have led to greater awareness. Burkina Faso and Nigeria are at earlier stages of the epidemic.[11]

It is important to note that despite improvements over time, a large share of the adult population in each country have an incomplete understanding of HIV prevention,

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[10] Some caution is called for here. The questions on limiting the number of partners change slightly between surveys for these two countries, most notably in that the earlier years alone allow a "have safe sex" response with a follow up prompt for what this means.

[11] The relatively low numbers of respondents identifying avoiding sexual relations are somewhat surprising. It is possible that , despite careful wording of the question in the DHS, respondents personalize the question, and do not think of abstinence a viable means of prevention because it is not a practical option for them. Or they may not consider abstinence as a distinct behavior from limiting the number of partners.

even though they have heard of the disease. Even in Uganda in 2001 only about half of women (rural or urban) were able to identify limiting the number of partners as a means of reducing the risk of infection. Only half of women in rural areas of Uganda, half of rural Tanzanian women, and less than half of rural Kenyan women knew that condoms can prevent infection.[12] The largest shortfall in knowledge, however, is in the two West African countries, where prevalence is still relatively low but threatens to erupt into a full-blown epidemic. Especially Nigeria: it is troubling, even alarming, that that less then 20% or urban women and less than 10% of rural women in a recent (2003) survey seem to know that the use of condoms can prevent HIV infection.

If one looks instead at the share knowing at least one of the prevention behaviors, the shortfall in knowledge appears much smaller. In most urban areas (the exception is Nigeria) 90% of respondents can identify one prevention behavior. At the other extreme—again in West Africa—only about 45% and 55% of rural women in Nigeria and Burkina Faso, respectively, can do so. Although overall this indicator presents a more favorable picture, it is not clear that the 'any means of prevention' measure is a better indicator of relevant knowledge than the indicators for specific measures. To some extent, individuals may only remember the option that seems most relevant to them: restriction to one partner for married individuals, condoms for sexually active single people. There is some evidence of this, as discussed below. However, with the possible exception of abstinence (which for most married individuals is not likely to be a realistic option), from a public health perspective, most adults should know about different means of preventing infection. Single people should know both about condoms and limiting the number of partners; married people should be aware of the role of condoms in HIV prevention given the possibility that one of the partners may test HIV positive (or for that matter, that they or their partners are not faithful to their spouses).

Among other patterns, prevention knowledge is higher in urban areas than in rural areas, except for the partial exception of Kenya for two of the indicators. Additional calculations, not shown, indicate that proportional rural-urban differences (meaning, the share of rural residents with knowledge of a prevention behavior relative to the urban share) have generally fallen between survey rounds, though not dramatically. There is also a gender gap: for most subsamples and HIV prevention behaviors, men are better informed than women. There is no evident pattern of change in these gender gaps (again, measured in proportional terms) except for Tanzania, where the male advantage has declined for most indicators in urban as well as rural areas. Both the locational and gender differences in HIV knowledge can be interpreted in terms of differences in the accessibility or cost of information as suggested earlier. Information is more readily

[12] Uganda is a very interesting example because the country has famously managed to turn the tide on the epidemic. Incidence and prevalence are thought to have begun falling before 1995, the year of our first survey—yet as seen in the table in that year, the shares of women able to identify prevention behaviors were 50% or lower for each such behavior. However, prevalence fell in part due to mortality among those with AIDS and likely also among delayed or reduced sexual activity specifically among the young (see Parkhurst 2002; Konde Lule 1995), both of which are not incompatible with the population HIV knowledge means from the DHS.

available in urban centers; women may be less able to access or process information by virtue of having less schooling and also, possibly, have social networks that provide less AIDS-related information than do men's. It is noteworthy that the gender gap in knowledge is almost always larger, sometimes sizably so, in rural areas. This may be because publicly provided HIV/AIDS information disproportionately impacts women (who lack either the schooling or information networks men have), and this information is more readily available in urban areas. Note, however, that the patterns by location and gender may also reflect correlations of location and gender with schooling and wealth.

In Table 2 we look at the prevention knowledge indicators and changes in them disaggregated by age category. Several other studies (e.g., Dietrich et al, 1998, Glick, Randriamamonjy and Sahn 2004) have shown that HIV/AIDS knowledge varies by age, often taking an inverted U-shape, reflecting either true age effects or cohort effects, or both. The first row for each subsample in the table shows the share identifying the given prevention measure in the later survey year for each country. Below this in italics is the proportional change for the indicator over the earlier survey, specifically, the year 2 share over the year 1 share for that age group. We are able to pick out some general patterns with respect to age. Looking first at the indicator for knowledge of any prevention behavior in the last set of columns, there is a fairly consistent but modest quadratic pattern in age: knowledge is highest among 26-35 year olds, and somewhat lower among those age 15-25 and 36-45. Consideration of the individual outcomes reveals that knowledge of condom use tends to be larger among the youngest group than the oldest, while the opposite is the case for limiting the number of partners. As noted earlier, people may be better at identifying the prevention behavior that seems the most relevant to their situation. Thus older respondents, who tend to be married, have a tendency to identify having one partner as a prevention measure, while young respondents, who are more likely to be single, tend to know about condom use. Young people may also have had more exposure to messages about condoms.

Comparisons across age groups in *changes* in knowledge are of interest as they provide a sense of whether messages have been disproportionately targeting (or been effective with) younger or older individuals. An examination of the proportional change indicators in the table shows a tendency for the growth in knowledge to have occurred faster among the older two age groups than among 15-25 year olds. This is a clue that school-based messages have not played a large role in disseminating HIV/AIDS knowledge.[13]

[13] Note the comparisons of change across age groups is not a cohort analysis: we are not considering how knowledge has changed among say, individuals who were 15-25 at the time of the first survey. This could be accomplished by constructing synthetic cohorts. What the comparisons we report do show is whether, for example, 15-25 year olds know more now than 15-25 years olds knew before, and how this change compares with other age groups.

Testing and the desire to be tested

We turn now to the trends in HIV testing and the desire to be tested, shown in Table 3. There clearly has been an increase in the number of people who have had an HIV test, as governments have increased the availability of voluntary counseling and testing services (some people may have been tested at maternity clinics or been subject to mandatory testing by employers or other institutions). With some exceptions, however, the numbers tested still remain very low. The exceptions are urban Uganda, where 23% of women reported testing in 2001, and more strikingly, urban Kenya, where in both the 2003 *and* 1998 surveys over one fourth of the female and male samples reported having been tested. The earlier year figures frankly seem implausibly high given the limited availability of VCT in Kenya at that time, at least of publicly provided services.[14] Elsewhere, the low numbers reflect the continued lack of testing services, especially in rural areas, as well as a possible reluctance to use services that are available (see Glick 2004). With the exception of Kenya, men are typically more likely to be tested than women, and rates of testing are typically twice as high or more in urban areas than rural areas. The latter pattern is not surprising since VCT services have been slow to penetrate into rural areas.[15]

The one indicator that does not seem to have changed over time is the share of never-tested individuals who say they would like to be tested. This is shown in the middle columns of Table 3; note these calculations are conditional both on indicating that one has not been tested and on having heard of HIV/AIDS. The share of such individuals desiring testing is consistently high—usually between 60-75 percent, for either survey year. The exception is women in Nigeria, where only 52% or urban women and 42% of rural women who have heard of AIDS and have not been tested say they would like to be tested. If instead we construct an unconditional indicator of the 'total demand' for testing that also includes those who have been tested (though as we note below it is far from clear that saying one wants to test is equivalent to actually testing) the shares are slightly higher (last two columns) but usually not very much so, because of the generally low numbers who have been tested. For the same reason, changes over time in this indicator are similar to that for the conditional indicator, which is to say, very small.

The apparent high desire for testing in almost all sample countries may be considered a favorable indicator of HIV prevention prospects, but some caution is called

[14] Our concern is not so much with misreporting by respondents but with whether those interviewed are truly representative of the urban population.

[15] With respect to the gender gap in testing experience, one can hypothesize more speculatively that the implicit costs of testing are higher for women (Glick 2004). They probably have more to lose in terms of the stability of their partnerships from testing, especially if testing positive (and if observed or discovered by their spouses) or from stigma generally. If they are less mobile, it may be harder for them to find ways to test discretely. The fact that the reported desire to be tested is similar for men and women while actual testing behavior differs lends some credence to this idea.

for. Saying one would like to test and actually going through with it are two different things, as suggested by the findings of a few studies that have collected information on both in settings where VCT was readily available (see Fylkesnes and Siziya 2004 and the discussion in Glick 2004). In addition, it seems slightly odd that a larger share of people say they want to get tested than know about most of the means of prevention. It is also surprising that unlike with the knowledge indicators, there are essentially no gaps between rural and urban areas in desire to test using either the conditional or unconditional testing demand measures.

V.2 Determinants of HIV prevention knowledge and testing

We turn to the estimated impacts of education, age and household assets on our outcome variables, based on our probit model results. As discussed above, we show marginal effects, that is, the derivatives of the predicted probability with respect to the variable.[16] Given the non-linearity of the quadratic specifications of the index function (as well as of the probit model itself) we calculate schooling and age marginal effects at two points: for schooling, 4 and 8 years, corresponding to some primary and (in most countries) primary plus two years of secondary education; for age, 20 and 40 years. All other covariates are set to their mean values for the calculations. The variances of the marginal effects were calculated using the delta method. To save space we report these results only for the most recent survey from each country; subsequent tables will analyze changes in impacts over time.

Education has positive and statistically significant impacts on the three HIV knowledge outcomes almost if not quite totally across the board (Table 4)—in all countries, in rural and urban areas, and for women and (where data are available) men. The magnitudes are fairly large for condom knowledge, especially in Uganda and Tanzania. For example, for women with four years of education in rural Tanzania the effect of an additional year is 0.043, implying that primary school completion raises the probability of knowing about condoms as a means of prevention by about 22 percentage points over women with no schooling. Elsewhere and for other knowledge outcomes the impacts of schooling tend to be more modest but still make clear that education confers non-trivial prevention knowledge benefits. We do not observe any consistent pattern with respect to changes in the gradient between lower and higher levels of schooling, reflecting the varying patterns in the probit model coefficients on years of schooling and its square.

Nor does any pattern emerge with respect to rural and urban differences. As discussed in section II, whether schooling effects are greater in rural or urban areas depends on differences between areas in how schooling affects access to information as well as on the nature of the health knowledge production technology. In only a few cases are rural-urban differences statistically significant (denoted in the table using bold type for larger effect of the pair) and these do not always indicate a larger effect in rural areas. Even in the same country (Uganda) schooling can have a larger impact in rural areas for

[16] The complete set of probit results can be obtained from the authors.

one outcome (condom knowledge) but a larger effect in urban areas for another (knowing that limiting the number of partners reduces risk).

Education also has positive and generally significant impacts on the probability of having been tested, consistent with expectations. These impacts are more likely to be significant in urban areas, but this may be because in most rural settings few respondents have been tested so there is relatively little variation in the dependent variable. Among the majority that has not been tested, the stated desire to be tested also tends to increase with level of schooling.

Table 5 calculates differences in male and female schooling marginal effects and their standard errors. In two countries—Kenya and Nigeria—the impacts of schooling on knowledge of prevention behaviors are generally significantly larger for men, and for Nigeria, schooling also has generally larger effects for men on testing and the desire to be tested. In other countries there are few significant gender differences, but where they exist they also tend to show larger effects for men. In terms of the conceptual framework discussed earlier, higher schooling returns to education for men will occur if men have greater access to HIV-related information and this information and schooling are complementary inputs in the production of HIV knowledge.

In Table 6 we turn to the effects of assets. The marginal effects are evaluated at the mean values of the asset index (and of the other covariates). As expected, there is an overall pattern of better HIV prevention knowledge among those in wealthier households, though not all of the estimates are statistically significant and a few are actually negative, though insignificant. The table also reports tests of rural-urban differences in the effects of wealth. Although not many of the gaps are significant, the point estimates overall tend to be larger for rural areas. This pattern is consistent with the existence of larger wealth-related differentials in access to HIV/AIDS information in rural areas than in urban areas. As Table 7 shows, there are relatively few significant gender differences in the effects of assets on prevention knowledge, but those that are found tend to show larger impacts on males.

Testing probabilities also tend to be greater among individuals with more assets (Table 6) and there is some indication that the effects of assets are larger for men than for women (Table 7). What is unexpected are a number of negative impacts on the desire to be tested conditional on not having been tested (Table 6, last column). This is the case, for example, for women in Uganda in both rural and urban areas and women in rural areas of Kenya. One might surmise that these results reflect the conditioning on the non-tested sample: perhaps the well-off who desire to test have already managed to do so. However, this interpretation is not convincing: first, the share of those tested is often very small (e.g., rural women in Uganda), and second, in some of these cases we fail to find a significant positive association (or even find a negative but insignificant association) of assets and actual testing probabilities. Together with other unexpected findings for the desire to test noted in the descriptive analysis above, this result leads to some uncertainty as to how to interpret the desire to be tested indicator.

Marginal effects of age, evaluated at 20 years and 40 years, are shown in Table 8. Reflecting the negative sign on the quadratic terms in the probit models, the effect of an additional year is almost always larger at 20 years than at 40 years (by which point the slope often turn negative). This is also consistent with the descriptive data in Table 2. The strongest suggestions of an inverse U-shape in knowledge by age level are in the estimates for knowledge of condoms and of limiting the number of partners. It should be noted that our estimates may not be capturing only a true age effect but also a cohort effect, since individuals in different age categories at the time of the survey were first exposed to HIV information at different periods of the epidemic.

Finally, we briefly mention the estimates for our controls for being married or cohabitating and for the schooling of the partner (results are suppressed to save space). First, the years of schooling of the partner has almost universally positive, and generally significant, effects on each prevention knowledge outcome, as well as on the probabilities of testing and desiring to be tested. This finding is interesting though difficult to interpret. It may indicate that partners share knowledge about HIV so that someone with an educated partner has an additional source of information on HIV prevention. Alternatively there is a plausible assortative mating story: individuals who are more interested in leaning about HIV also prefer well-educated partners.

The effects of the dummy indicator for being in a partnership depend on the outcome being considered, but in a fairly logical way. Individuals in such a relationship are usually more likely than those who are single to know HIV risk can be reduced by limiting the number of partners (which incorporates having one partner/being faithful to ones' spouse). In contrast, individuals in partnerships are usually *less* likely than single people to report that avoiding sexual relations altogether can prevent HIV transmission. For condoms, the effects of being in a partnership are negative in some case and positive in others. There is no effect of the partnership indicator on either of the testing outcomes. The opposing patterns for 'limit the number of partners' and abstinence knowledge imply that, as we have already suggested, people may be more apt to remember or to mention options that seem relevant for them—keeping to one's partner for those in steady relationships, avoiding having sex for those who are not.

Changes over time in the effects of schooling and wealth

We now consider changes in the effects of education and wealth on HIV prevention knowledge and testing. Table 9 reports the differences in marginal effects of schooling between surveys, again evaluated at 4 and 8 years of school. As a crude indicator of whether and how the gradients of prevention knowledge with respect to education have changed, we note that out of 132 paired year to year comparisons (defined by subsample, outcome variable, and use of 4 or 8 years of schooling), 31 of the differences are significant at the 10% level or better, and of these, about two-thirds (20) are positively signed. Alternatively, if we group the 4 and 8 year results together and consider a change in the effect of education to occur for a subsample if a significant

change for the outcome is found at either point, we have 23 changes out of 66 cases, again with two thirds (17) increasing.

This suggests that the impacts of schooling on knowledge are stable over time in at least a slight majority of cases, but with a tendency on balance for the impacts to increase. Country-specific examination is more informative. For Uganda in particular, the knowledge returns to schooling appear to have risen between survey years. This is consistent with the study of de Walque (2002), who found no robust relation between education and seropositivity for 1990 in data from rural Masaka District in Uganda but a negative association among young individuals in 2000, following a decade of prevention campaigns.[17] Increases in the knowledge/education gradient are seen as well, though not as consistently, in Kenya and Zambia. In Nigeria in contrast there appears to have been a decline in marginal schooling effects on prevention knowledge for women, but not men, between surveys. For the probability of having been tested or wanting to test, we see little change in education impacts over time.

We repeat the exercise for the asset index marginal effects in Table 10. Only 13 of the 72 paired year to year differences in the effect of wealth on prevention knowledge are significant—and these are evenly split between increases and decreases. For condom knowledge, the marginal impact of wealth increased for rural men in Kenya while it decreased for men in rural areas of Burkina Faso and Nigeria as well as in urban Nigeria and Tanzania. The effect of wealth on the probability of knowing that limiting the number of partners can prevent infection declined in Burkina Faso and Tanzania. Relative to the changes seen in the previous table for schooling marginal effects, however, there are fewer consistent stories within countries. For example, in Tanzania, the marginal effect of assets on knowledge of condom use and limiting the number partners generally declined while it increased for abstinence knowledge. In no case did the effect of wealth on testing probabilities change over time, and the same is true with only one exception (rural men in Kenya) for the desire to be tested.

Thus there are some changes in the impacts of schooling and (to a lesser extent) wealth but no consistent pattern for the sample of countries as a whole, but this is not necessarily surprising in light of the conceptual discussion above. As noted, if public (or private) sources of information about the disease operate mainly through channels that are accessed by the educated, or if the reduction in the costs of acquiring information is neutral with respect to education but the educated are better at processing HIV information, the distribution of HIV knowledge will skew toward this group even as mean levels of knowledge rise (i.e., the returns to schooling will rise). If instead public campaigns work though channels accessible to the poorly educated and/or tailor the message to be understood by them, knowledge among the less educated may rise more

[17] De Walque argues that the reason was that the information provided in these campaigns was more easily absorbed by the educated—i.e., that schooling and information are complements in the production function for HIV knowledge—rather than that the uneducated in the study villages has less access to the information.

(the returns to schooling fall). Based on our estimates, this last case seems to be the least common. More typically, growth in knowledge has either been 'distributionally neutral' in regards to both schooling and wealth, or as in the case of Uganda has tended to be greater among those with more schooling. In these cases, whatever AIDS information campaigns have been put in place over time have failed to reduce and may have increased the initial relative disadvantage of the poorly educated.

VI. CONCLUSIONS

Examination of repeated rounds of Demographic and Health Surveys from six African countries reveals that knowledge of HIV prevention has been increasing over time, though at different rates in different countries. In several countries the vast majority of respondents, at least in urban areas, can now identify at least one prevention behavior, though the shares capable of identifying any given behavior are much lower. While this improvement is encouraging, some aspects of the data are troubling. Even where prevention knowledge is relatively high, as in urban areas of Uganda or Kenya, a substantial minority of individuals still appear to be unaware that using condoms can reduce the risk of infection, and many are unable to identify limiting the number of sexual partners as a way to reduce risk. In many cases not even half of adults can identify specific means of prevention. In the two West African countries in this sample, levels of prevention knowledge remain very inadequate. In one of them, Nigeria, the increases in knowledge have been small and limited to only certain segments of the population.

Though they are falling, rural-urban gaps in prevention knowledge are large. In addition, women tend to be disadvantaged relative to men, and these gender gaps for the most part do not seem to be closing. It is not surprising that HIV knowledge is greater among urban residents, given the higher density of social networks and of channels for public messages about the disease in urban environments. Obviously more needs to be done to get these messages to rural inhabitants. With respect to gender differences, it is frequently pointed out that women are disadvantaged in relationships with respect to their ability to negotiate safe sex practices. Their lower levels of knowledge of these practices, revealed by the DHS data, obviously deepen even further their vulnerability to the disease. Strategies are needed that can rectify these gender discrepancies while continuing to increase overall levels of knowledge.

In proportional terms the largest increases among the outcomes considered have been in the shares of men and women who report having been tested for HIV. These increases have usually been from a very small base, however. Other than in Uganda and Kenya, the numbers tested remain quite low, especially in rural areas.

Multivariate analysis highlights the positive impacts on HIV prevention knowledge of schooling and household wealth. These results confirm findings in earlier studies, but in this study we have also considered whether the importance of these factors has changed over time. In some cases, but not the majority, they have, especially for

education. The picture is mixed, but where the effects of schooling on knowledge have changed they have tended to increase. This was seen fairly clearly for Uganda. In these cases, the distribution of prevention knowledge has become more skewed toward the well educated even as mean levels of prevention knowledge have risen. In other cases the growth in knowledge has been 'distributionally neutral' – i.e., not changing the initial disparities between the uneducated and educated, or the poor and the wealthy. In fewer cases have returns to schooling or wealth actually fallen.

Thus in most cases those who are poor or lack schooling remain at a constant or increasing disadvantage with respect to HIV knowledge. To reach these groups, and ultimately to reduce their vulnerability to infection, policies must be reoriented. As to how to do this, the DHS data unfortunately do not permit us to evaluate efficacy of specific HIV education interventions. However, from our results we can infer that existing programs have not been effective in one or two ways, or both: in reaching the poor and less educated, and in tailoring messages that these groups can easily understand. This suggests some directions for change, for example, disseminating more information through community health workers in rural areas, church organizations and community leaders, in addition to standard mass media channels such as newspapers or television.

Finally, we should point out that in countries such as Zambia and Uganda which have experienced a large scale AIDS epidemic, improvements in knowledge have occurred only in step with, or even behind, the epidemic. In part this is because governments have responded with mobilization campaigns only after they were confronted with massive devastation from AIDS. At the same time, individuals on their own probably made efforts to learn more about the disease that was causing such evident suffering all around them. These hard-earned gains in knowledge have probably helped, or will help, to curb the epidemic in these countries. Even better, of course, would be the use of intensive public education efforts to improve HIV/AIDS knowledge and change behavior before the epidemic can take hold. In this respect the findings for Burkina Faso and especially Nigeria are discouraging, as they suggest that education efforts on a scale that might prevent a repeat of the catastrophe that befell most of the other countries in our sample are not being made. Increasing awareness of HIV prevention, and of course the reductions in risk behavior for which awareness is a prerequisite, should be the highest of priorities for governments in these contexts.

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Table 1 - Share of sample with HIV/AIDS awareness and knowledge of prevention behaviors

			Knows that ___ can prevent infection:							
	Heard of HIV/AIDS		Condom		Abstain		Limit partners[a]		Any of the 3	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Burkina Faso (92/93, 98/99)										
Urban										
Female	0.98	0.99	0.38	0.58	0.04	0.12	0.48	0.53	0.72	0.86
Male	0.98	1.00	0.61	0.78	0.05	0.18	0.59	0.55	0.87	0.94
Rural										
Female	0.81	0.85	0.08	0.13	0.02	0.05	0.35	0.46	0.41	0.55
Male	0.92	0.95	0.28	0.48	0.04	0.10	0.51	0.59	0.68	0.77
Kenya (98, 03)										
Urban										
Female	1.00	0.99	0.52	0.50	0.32	0.47	0.56	0.56	0.86	0.89
Male	1.00	1.00	0.56	0.64	0.33	0.52	0.49	0.62	0.91	0.95
Rural										
Female	0.99	0.98	0.33	0.38	0.26	0.41	0.49	0.61	0.77	0.84
Male	0.99	0.99	0.46	0.54	0.28	0.55	0.46	0.64	0.83	0.9
Nigeria (99, 03)										
Urban										
Female	0.88	0.95	0.17	0.19	0.14	0.19	0.48	0.45	0.61	0.68
Male	0.96	0.99	0.39	0.31	0.22	0.28	0.43	0.32	0.73	0.67
Rural										
Female	0.68	0.82	0.07	0.09	0.10	0.16	0.34	0.30	0.44	0.45
Male	0.87	0.96	0.21	0.24	0.23	0.27	0.37	0.32	0.58	0.62
Tanzania (96, 99)										
Urban										
Female	1.00	1.00	0.55	0.73	0.18	0.35	0.44	0.65	0.73	0.91
Male	1.00	1.00	0.64	0.82	0.32	0.39	0.41	0.62	0.83	0.93
Rural										
Female	0.96	0.96	0.33	0.49	0.13	0.25	0.34	0.51	0.55	0.76
Male	0.99	0.99	0.51	0.67	0.19	0.28	0.33	0.53	0.67	0.85
Uganda (95, 01)										
Urban										
Female	1.00	1.00	0.46	0.78	0.38	0.64	0.43	0.47	0.86	0.94
Male	1.00	1.00	--	--	--	--	--	--	--	--
Rural										
Female	0.99	1.00	0.17	0.50	0.33	0.47	0.49	0.50	0.72	0.84
Male	--	--	--	--	--	--	--	--	--	--
Zambia (96, 01/02)										
Urban										
Female	1.00	1.00	0.50	0.63	0.32	0.53	0.51	0.53	0.89	0.92
Male	1.00	1.00	0.58	0.67	0.42	0.59	0.55	0.36	0.96	0.93
Rural										
Female	0.99	0.99	0.29	0.39	0.25	0.38	0.47	0.47	0.77	0.78
Male	0.99	0.98	0.42	0.58	0.37	0.49	0.43	0.36	0.86	0.9

[a] In most surveys, includes response of either "be faithful to one partner" or "avoid multiple partners" or both. See text for details.

Source: DHS, indicated years.

Table 2 - Share of sample with knowledge of HIV/AIDS Prevention Behaviors, by Age Group

	Knows that __ can prevent infection:											
	Condom			Abstain			Limit partners			Any of the 3		
	Age Group			Age Group			Age Group			Age Group		
	15-25	26-35	36-45	15-25	26-35	36-45	15-25	26-35	36-45	15-25	26-35	36-45
Burkina Faso (92/93, 98/99)												
Urban												
Female	0.63	0.59	0.45	0.13	0.09	0.13	0.44	0.64	0.62	0.83	0.9	0.85
	1.60	*1.39*	*1.67*	*3.02*	*2.85*	*4.33*	*1.00*	*1.19*	*1.27*	*1.15*	*1.15*	*1.30*
Male	0.83	0.82	0.72	0.18	0.21	0.17	0.48	0.56	0.64	0.94	0.96	0.92
							0.88	0.88	0.96	1.02	1.04	1.06
Rural												
Female	0.14	0.16	0.10	0.06	0.03	0.04	0.39	0.51	0.48	0.50	0.61	0.56
	1.42	*1.72*	*1.91*	*3.33*	*2.43*	*2.53*	*1.18*	*1.35*	*1.37*	*1.25*	*1.39*	*1.45*
Male	0.47	0.58	0.49	0.12	0.10	0.09	0.38	0.69	0.74	0.66	0.85	0.85
							0.83	1.23	1.25	0.87	1.03	1.17
Kenya (98, 03)												
Urban												
Female	0.52	0.52	0.45	0.50	0.44	0.45	0.45	0.66	0.64	0.86	0.92	0.9
	1.01	*0.94*	*0.89*	*1.52*	*1.50*	*1.33*	*0.96*	*1.06*	*1.08*	*1.02*	*1.05*	*1.03*
Male	0.68	0.64	0.59	0.59	0.55	0.42	0.46	0.71	0.72	0.93	0.96	0.96
	1.03	*1.14*	*1.26*	*1.76*	*1.88*	*1.17*	*1.10*	*1.31*	*1.38*	*1.03*	*0.99*	*1.00*
Rural												
Female	0.39	0.42	0.32	0.48	0.34	0.38	0.49	0.72	0.70	0.82	0.86	0.85
	1.17	*1.09*	*1.23*	*1.67*	*1.45*	*1.47*	*1.23*	*1.28*	*1.27*	*1.11*	*1.05*	*1.12*
Male	0.55	0.58	0.51	0.61	0.53	0.47	0.47	0.75	0.80	0.87	0.94	0.93
	1.04	*1.23*	*1.43*	*1.95*	*2.00*	*1.83*	*1.48*	*1.31*	*1.40*	*1.06*	*1.09*	*1.11*
Nigeria (99, 03)												
Urban												
Female	0.20	0.23	0.12	0.22	0.19	0.16	0.37	0.50	0.53	0.64	0.72	0.68
	1.18	*1.15*	*0.92*	*0.13*	*1.58*	*1.45*	*0.92*	*0.94*	*0.97*	*1.08*	*1.14*	*1.10*
Male	0.35	0.36	0.25	0.32	0.27	0.25	0.18	0.38	0.47	0.63	0.75	0.7
	0.83	*0.75*	*0.74*	*1.23*	*1.29*	*1.19*	*0.57*	*0.71*	*0.95*	*0.89*	*0.91*	*0.97*
Rural												
Female	0.10	0.09	0.06	0.17	0.16	0.14	0.26	0.36	0.29	0.44	0.49	0.42
	1.25	*1.00*	*1.50*	*1.21*	*2.29*	*1.75*	*0.88*	*0.97*	*0.79*	*0.99*	*1.09*	*0.98*
Male	0.28	0.31	0.18	0.33	0.26	0.23	0.18	0.38	0.42	0.59	0.72	0.61
	1.20	*1.15*	*1.12*	*1.20*	*1.30*	*1.09*	*0.74*	*0.93*	*0.99*	*1.09*	*1.18*	*1.05*
Tanzania (96, 99)												
Urban												
Female	0.68	0.80	0.72	0.41	0.30	0.33	0.51	0.77	0.74	0.88	0.96	0.91
	1.30	*1.26*	*1.43*	*2.41*	*1.58*	*1.68*	*1.42*	*1.54*	*1.45*	*1.31*	*1.19*	*1.20*
Male	0.79	0.88	0.85	0.39	0.37	0.40	0.49	0.77	0.61	0.87	0.99	0.96
	1.19	*1.22*	*1.49*	*1.53*	*1.00*	*1.06*	*1.76*	*1.91*	*1.16*	*1.09*	*1.15*	*1.12*
Rural												
Female	0.46	0.59	0.43	0.25	0.23	0.28	0.46	0.56	0.55	0.72	0.81	0.75
	1.41	*1.56*	*1.56*	*1.99*	*1.86*	*1.79*	*1.59*	*1.60*	*1.42*	*1.41*	*1.38*	*1.34*
Male	0.64	0.79	0.66	0.27	0.25	0.30	0.37	0.61	0.63	0.79	0.92	0.88
	1.24	*1.42*	*1.29*	*1.51*	*1.31*	*1.48*	*1.42*	*1.66*	*1.57*	*1.23*	*1.28*	*1.24*

Table 2 - Share of sample with knowledge of HIV/AIDS Prevention Behaviors, by Age Group

		Knows that __ can prevent infection:											
		Condom			Abstain			Limit partners			Any of the 3		
		Age Group			Age Group			Age Group			Age Group		
		15-25	26-35	36-45	15-25	26-35	36-45	15-25	26-35	36-45	15-25	26-35	36-45
Uganda (95, 00)													
Urban													
	Female	0.81	0.78	0.71	0.64	0.63	0.63	0.44	0.51	0.48	0.94	0.94	0.94
		1.77	*1.60*	*1.86*	*1.61*	*1.77*	*1.59*	*1.10*	*1.11*	*1.09*	*1.09*	*1.12*	*1.09*
Rural													
	Female	0.54	0.52	0.41	0.47	0.45	0.48	0.44	0.56	0.53	0.84	0.86	0.83
		2.64	*2.95*	*3.29*	*1.38*	*1.46*	*1.39*	*0.96*	*1.06*	*1.04*	*1.17*	*1.19*	*1.14*
Zambia (96, 01/02)													
Urban													
	Female	0.64	0.65	0.55	0.57	0.48	0.52	0.44	0.61	0.61	0.91	0.94	0.92
		1.30	*1.14*	*1.32*	*1.62*	*1.76*	*1.55*	1.05	1.03	1.00	1.06	*1.02*	*1.01*
	Male	0.71	0.72	0.59	0.61	0.56	0.62	0.21	0.46	0.46	0.91	0.96	0.94
		1.15	*1.24*	*1.17*	*1.41*	*1.20*	*1.86*	0.50	0.73	0.69	0.96	*0.98*	*0.99*
Rural													
	Female	0.38	0.43	0.36	0.38	0.36	0.39	0.38	0.53	0.53	0.75	0.82	0.80
		1.33	*1.31*	*1.55*	*1.38*	*1.70*	*1.55*	0.93	1.00	1.04	1.00	*1.03*	*1.04*
	Male	0.62	0.60	0.57	0.48	0.47	0.50	0.16	0.46	0.51	0.84	0.93	0.95
		1.31	*1.64*	*1.44*	*1.12*	*1.68*	*1.87*	0.55	0.85	0.86	0.99	*1.04*	*1.06*

Note: shows share by age group for later (year 2) survey. Figures in italics show the ratio of this to the year 1 share.

Table 3 - Share of Sample reporting having been tested for HIV and wanting to be tested

	Have been Tested[a]		Want to be tested[b]		Have been or want to be tested[a]	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Burkina Faso (92/93, 98/99)						
Urban						
Female	–	–	–	–	–	–
Male	–	–	–	–	–	–
Rural						
Female	–	–	–	–	–	–
Male	–	–	–	–	–	–
Kenya (98, 03)						
Urban						
Female	0.28	0.27	0.55	0.64	0.68	0.74
Male	0.29	0.26	0.66	0.66	0.76	0.75
Rural						
Female	0.13	0.13	0.68	0.67	0.72	0.72
Male	0.15	0.14	0.68	0.71	0.72	0.75
Nigeria (98, 03)						
Urban						
Female	–	0.15	–	0.52	–	0.59
Male	–	0.22	–	0.71	–	0.77
Rural					–	
Female	–	0.04	–	0.40	–	0.42
Male	–	0.15	–	0.61	–	0.67
Tanzania (96, 99)						
Urban						
Female	0.08	0.14	0.72	0.70	0.74	0.74
Male	0.20	0.20	0.69	0.70	0.75	0.76
Rural						
Female	0.03	0.05	0.67	0.68	0.68	0.70
Male	0.10	0.11	0.74	0.72	0.77	0.75
Uganda (95, 01)						
Urban						
Female	0.18	0.25	0.62	0.61	0.69	0.71
Male	–	–	–	–	–	–
Rural						
Female	0.04	0.06	0.71	0.72	0.72	0.73
Male	–	–	–	–	–	–
Zambia (96, 01/02)						
Urban						
Female	–	0.15	–	0.71	–	0.75
Male	–	0.18	–	0.67	–	0.73
Rural						
Female	–	0.07	–	0.77	–	0.79
Male	–	0.13	–	0.77	–	0.80

[a] Not conditional on having heard about HIV/AIDS

[a] Share of non-tested indicating a desire to be tested. Conditional on have heard about HIV/AIDS

Source: DHS, indicated years.

Table 4: Marginal Effects of Education, Year 2

Sample/Outcome:	Knows that ___ can prevent infection: Condom		Abstinence		Limit Partners		Tested		Want to be tested[a]	
	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years
Burkina Faso										
Women										
Rural	0.011 **	0.022 **	0.001	0.003 *	**0.014** **	0.001	–	–	–	–
Urban	0.021 **	0.018 **	-0.001	0.003 **	-0.002	0.008 **	–	–	–	–
Men										
Rural	-0.001	**0.031** **	**0.011** *	**0.011** **	-0.003	0.004	–	–	–	–
Urban	**0.016** **	0.013 **	-0.002	0.003	-0.007	0.003	–	–	–	–
Kenya										
Women										
Rural	0.022 **	0.017 **	0.011 **	0.019 **	0.008 *	0.013 **	0.008 **	0.013 **	0.007	-0.004
Urban	0.024 **	0.014 **	0.005	0.015 **	**0.030** **	0.020 **	0.002	0.014 **	0.005	-0.013 **
Men										
Rural	0.013 *	0.013 **	0.030 **	0.029 **	0.034 **	0.018 **	0.012 **	0.013 **	0.019 **	-0.002
Urban	**0.046** **	**0.032** **	0.036 **	0.039 **	0.021 **	0.018 **	-0.012	0.003	0.013	0.001
Nigeria										
Women										
Rural	0.009 **	0.008 *	0.001	0.005	0.008 *	0.008	0.005 **	0.012 **	0.010 **	**0.020** **
Urban	0.018 **	0.010 *	0.001	-0.003	**0.022** **	**0.024** **	0.011 **	0.012 **	0.019 **	0.006
Men										
Rural	0.030 **	**0.048** **	0.026 **	0.020 **	0.010	0.009	0.024 **	0.024 **	0.032 **	0.036 **
Urban	0.046 **	0.028 **	0.004	0.023 **	-0.006	0.006	0.035	0.039	-0.007	0.001
Tanzania										
Women										
Rural	0.043 **	0.023 *	0.007 *	0.012	0.020 **	0.012	0.008 **	0.007	0.011 **	-0.002
Urban	0.041 **	0.013 *	**-0.018** *	0.003	0.028 **	0.011	0.005	0.012	0.009 **	0.007 **
Men										
Rural	0.020 **	0.014 **	0.006	0.004	0.001	0.011 **	0.002	0.003 *	0.014	0.009
Urban	0.035 **	0.016 **	-0.007	0.004	0.016	0.017 **	0.002	0.008	-0.001	0.004
Uganda										
Women										
Rural	0.039 **	**0.046** **	0.016 **	0.019 **	0.019 **	0.016 **	0.009 **	0.023 **	**0.010** **	0.001
Urban	0.030 **	0.022 **	0.015 **	0.026 **	0.016 **	**0.034** **	0.012 **	0.023 **	-0.007	0.006
Men										
Rural	–	–	–	–	–	–	–	–	–	–
Urban	–	–	–	–	–	–	–	–	–	–
Zambia										
Women										
Rural	0.010 **	0.018 **	-0.004	0.006 **	0.004	0.010 **	0.004 **	0.005 **	0.009 **	0.003 **
Urban	0.011 *	0.015 **	-0.002	0.009 **	0.000	0.005	0.005 *	0.006 **	0.007	0.002
Men										
Rural	0.020 **	0.016 **	-0.007	0.008 **	0.002	0.015 **	0.007	0.007 *	0.014 *	0.005
Urban	0.023	0.013	0.015	0.021 **	**0.023** **	0.023 **	-0.010	-0.001	0.013	0.005

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows effect of an additional year of schooling on the probability of the outcome variable, evaluated at 4 and 8 years of schooling.

**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Bold face indicates that the rural (urban) value is significantly larger than the urban (rural) value at 10% or better.

[a] Share of those not tested indicating a desire to be tested

Table 5: Gender Differences in Marginal Effects of Education,Year 2

Sample/Outcome:	Knows that _ can prevent infection: Condom		Abstinence		Limit Partners		Tested		Want to be tested[a]	
	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years
Burkina Faso										
Rural	-0.012	0.009	0.010 *	0.008 *	-0.017 **	0.003	–	–	–	–
Urban	-0.005	-0.005	-0.001	0.000	-0.005	-0.005	–	–	–	–
Kenya										
Rural	-0.009	-0.004	0.019 **	0.010 *	0.026 **	0.005	0.003	0.000	0.012	0.002
Urban	0.023 *	0.018 **	0.031 **	0.024 **	-0.009	-0.002	-0.014	-0.011	0.009	0.014
Nigeria										
Rural	0.021 **	0.040 **	0.024 **	0.015 *	0.002	0.001	0.019 **	0.012	0.022 *	0.016
Urban	0.028 *	0.018 *	0.003	0.025 **	-0.028 **	-0.018 **	0.024 **	0.027 **	-0.026	-0.004
Tanzania										
Rural	-0.023 **	-0.008	-0.001	-0.008	-0.019 **	-0.001	-0.006	-0.004	0.003	0.010
Urban	-0.006	0.003	0.011	0.002	-0.012	0.006	-0.003	-0.005	-0.010	-0.003
Uganda										
Rural	–	–	–	–	–		–	–	–	–
Urban	–	–	–	–	–		–	–	–	–
Zambia										
Rural	0.010	-0.002	-0.003	0.002	-0.002	0.005	0.003	0.002	0.004	0.002
Urban	0.012	-0.002	0.018	0.011	0.023 **	0.018 *	-0.015	-0.007	0.006	0.003

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows differences in marginal effects (male minus female) of an additional year of schooling on the probability of the outcome variable, evaluated at 4 and 8 years of schooling.

'**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Table 6: Marginal Effects of Assets, Year 2

Sample/Outcome:	Knows that _ can prevent infection: Condom	Abstinence	Limit Partners	Tested	Want to be Tested[a]
Burkina Faso					
Women					
Rural	**0.060** **	**0.002**	**0.066** **	—	—
Urban	0.009	0.007	0.005	—	—
Men					
Rural	0.098 **	0.017	0.116 **	—	—
Urban	0.006	0.028 **	-0.012	—	—
Kenya					
Women					
Rural	0.031	0.009	0.036	0.000	-0.057 *
Urban	-0.019	-0.002	0.032	0.004	-0.003
Men					
Rural	0.085 **	0.053	-0.022	0.062 **	-0.002
Urban	0.020	0.075 **	0.039	0.036	0.061
Nigeria					
Women					
Rural	0.026	0.024	0.079 **	0.048 **	-0.012
Urban	0.048 **	0.025	0.020	0.070 **	0.001
Men					
Rural	-0.027	0.018	-0.017	0.058	0.028
Urban	-0.048	0.054	0.039	0.155 **	0.063
Tanzania					
Women					
Rural	**0.073** **	**0.046**	**-0.012**	**0.009**	0.015
Urban	-0.012	0.006	-0.014	-0.004	-0.033 **
Men					
Rural	**0.094** **	**0.102** **	**0.084** **	**0.054** **	-0.022
Urban	-0.007	-0.003	0.008	0.000	-0.011
Uganda					
Women					
Rural	**0.036**	**0.005**	**0.032** *	**-0.001**	-0.051 **
Urban	-0.004	0.012	-0.002	0.007	-0.027 **
Men					
Rural	—	—	—	—	—
Urban	—	—	—	—	—
Zambia					
Women					
Rural	-0.015	0.119 **	0.026	0.002	**0.020**
Urban	**0.039** **	**0.024**	**0.013**	**0.017**	-0.018
Men					
Rural	**0.137** **	**0.094** *	**-0.086**	**0.183** **	**0.046**
Urban	0.004	-0.037	-0.011	-0.034	-0.079 *

Note: based on probit estimates. Standard errors calculated using the delta method.

**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Bold face indicates that the rural (urban) value is larger than the urban (rural) value at the 10% level.

[a] Share of those not tested indicating a desire to be tested

Table 7: Gender differences in marginal effects of assets, Year 2

	Knows that _ can prevent infection:				
Sample/Outcome:	**Condom**	**Abstinence**	**Limit Partners**	**Tested**	**Want to be Tested[a]**
Burkina Faso					
Rural	0.038	0.015	0.050	—	—
Urban	-0.003	0.021	-0.017	—	—
Kenya					
Rural	0.054	0.044	-0.058	0.062 *	0.055
Urban	0.038	0.077 *	0.007	0.032	0.064
Nigeria					
Rural	-0.053	-0.005	-0.096	0.011	0.039
Urban	-0.096 *	0.029	0.018	0.085	0.062
Tanzania					
Rural	0.021	0.056 **	0.095 **	0.045 *	-0.037
Urban	0.005	-0.009	0.022	0.004	0.022
Uganda					
Rural	—	—	—	—	—
Urban	—	—	—	—	—
Zambia					
Rural	0.152 **	-0.025	-0.112 *	0.180 *	0.026
Urban	-0.035	-0.061	-0.025	-0.051	-0.061

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows the differences in marginal effects (male minus female).

** denotes significance at the 5% level. '*' denotes significance at the 10% level.

Table 8: Marginal Effects of Age, Year 2

Sample/Outcome:	Knows that _ can prevent infection: Condom		Abstinence		Limit Partners		Tested		Want to be Tested[a]	
	20 Years	40 Years	20 Years	40 Years	20 Years	40 Years	20 Years	40 Years	20 Years	40 Years
Burkina Faso										
Women										
Rural	0.005 **	-0.007	-0.003 **	0.001	0.010 **	-0.003	–	–	–	–
Urban	0.004	-0.016 **	-0.004 **	0.007	**0.023** **	-0.002	–	–	–	–
Men										
Rural	**0.016** **	**-0.014** **	0.004	0.002	**0.031** **	0.000	–	–	–	–
Urban	0.002	-0.004	0.000	-0.002	0.007	-0.004	–	–	–	–
Kenya										
Women										
Rural	-0.001	-0.008 **	-0.001	0.007 **	0.015 **	-0.002	-0.005 *	-0.005	-0.001	-0.011 **
Urban	0.001	-0.008 *	0.008	0.004	0.013 **	-0.004	0.001	-0.010	-0.004	-0.005
Men										
Rural	0.010 **	-0.009 **	-0.001	-0.003	0.025 **	0.000	0.010 **	-0.006	0.001	-0.001
Urban	0.007	-0.006 **	-0.008	-0.004	0.013 **	-0.001	0.012 *	-0.003	-0.010	**-0.008** **
Nigeria										
Women										
Rural	0.003	-0.003	0.002	0.002	0.004	0.001	0.006	-0.006	0.007 *	-0.009 *
Urban	0.003	-0.005	0.002	-0.003	0.003	0.008 *	0.011	-0.009	-0.002	-0.007
Men										
Rural	**0.028** **	-0.013 **	-0.011	0.001	0.020 **	0.003	0.020 **	-0.001	**0.020** **	0.002
Urban	-0.002	-0.009	-0.010	0.000	0.017 **	0.006 *	0.011	0.005	-0.006	**-0.012** **
Tanzania										
Women										
Rural	0.024 **	-0.019 **	0.001	0.008 **	0.012 **	-0.002	0.002 *	0.000	-0.001	-0.008 **
Urban	0.023 **	-0.011	-0.006	0.001	**0.031** **	-0.003	0.006	-0.004	-0.003	-0.007 *
Men										
Rural	0.018 **	-0.009 **	0.005	0.003 **	0.016 **	0.002	0.006	-0.001	0.007 *	-0.001
Urban	0.012 **	-0.003	0.000	0.005	0.014	-0.001	0.009	-0.001	-0.005	0.002
Uganda										
Women										
Rural	**0.005** *	-0.011 **	0.006 **	0.005 *	0.013 **	-0.004 **	0.000	-0.001	-0.005 *	-0.004 **
Urban	-0.002	-0.007 **	0.006 *	0.002	0.010 **	-0.006	**0.010** *	-0.014	-0.013 **	-0.004
Men										
Rural	–	–	–	–	–		–	–	–	–
Urban	–	–	–	–	–	–	–	–	–	–
Zambia										
Women										
Rural	0.010 **	-0.009 **	0.003	0.003 *	0.016 **	-0.004 *	0.001	-0.001	0.001	-0.004 **
Urban	0.009 **	-0.012 **	0.002	0.004	0.018 **	-0.004	-0.001	-0.002	-0.001	-0.004 *
Men										
Rural	0.004	-0.009 **	0.005	0.003	0.016 **	0.001	0.009 **	0.004	-0.007	-0.003
Urban	0.008	-0.010 **	0.007	-0.003	0.005	-0.004	0.007	0.005	-0.011	0.001

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows effect of an additional year on the probability of the outcome variable, evaluated at 20 and 40 years of age.

'' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Bold face indicates that the rural (urban) value is larger than the urban (rural) value at the 10% level or better.

[a]Share of those not tested indicating a desire to be tested

Table 9: Differences in marginal effects of education, Year 2 - Year 1

Sample/Outcome:	Knows that _ can prevent infection: Condom		Abstinence		Limit Partners		Tested		Want to be Tested[a]	
	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years
Burkina Faso										
Women										
Rural	-0.001	0.007	0.003	0.006	0.013 *	-0.010	–	–	–	–
Urban	0.001	-0.002	0.001	0.005 **	-0.005	-0.003	–	–	–	–
Men										
Rural	-0.006	0.003	0.010	-0.008	-0.008	-0.005	–	–	–	–
Urban	-0.010	-0.001	0.007	0.004	-0.013	-0.009 *	–	–	–	–
Kenya										
Women										
Rural	-0.002	-0.003	0.002	0.011 *	0.000	-0.009	0.002	-0.003	-0.002	0.000
Urban	-0.005	-0.008	0.007	0.014 *	0.007	-0.002	-0.005	0.000	-0.001	-0.017
Men										
Rural	-0.028 **	-0.011	0.032 **	0.021 **	0.002	-0.019 **	-0.003	-0.004	0.024 **	0.007
Urban	0.056 **	0.032 **	0.021	0.025 **	0.015	0.005	-0.035	-0.016	0.034	0.031
Nigeria										
Women										
Rural	0.001	-0.007	-0.001	0.003	-0.016 **	-0.013 *	–	–	–	–
Urban	0.005	-0.011 *	-0.014 *	-0.020 **	0.005	0.012	–	–	–	–
Men										
Rural	0.008	0.018 *	0.012	0.013	0.000	-0.012	–	–	–	–
Urban	0.010	0.004	-0.004	0.016	-0.019	-0.014	–	–	–	–
Tanzania										
Women										
Rural	0.009 *	-0.012	-0.002	0.003	0.001	-0.007	0.003	0.002	0.002	-0.009
Urban	0.008	-0.016 *	-0.029 **	-0.009	0.011	-0.005	0.001	0.008	0.006	0.004
Men										
Rural	-0.008	-0.012 **	0.009	-0.004	-0.010	-0.005	0.005	-0.002	-0.005	-0.004
Urban	0.019	0.001	-0.007	0.000	0.004	-0.001	0.010	0.007	-0.008	0.008
Uganda										
Women										
Rural	0.019 **	0.004	0.013 **	0.010	0.002	-0.012	0.003	0.020 **	0.002	0.000
Urban	-0.001	-0.007	0.014 *	0.021 **	0.013	0.023 **	-0.005	-0.003	-0.023 **	0.003
Men										
Rural	–	–	–	–	–	–	–	–	–	–
Urban	–	–	–	–	–	–	–	–	–	–
Zambia										
Women										
Rural	0.004	0.005 **	-0.005	0.003	0.001	0.005 **	–	–	–	–
Urban	0.001	0.003	0.001	0.012 **	-0.001	-0.004	–	–	–	–
Men										
Rural	0.001	-0.003	-0.017	0.001	-0.003	0.006	–	–	–	–
Urban	0.013	-0.001	0.028	0.030 **	0.002	0.002	–	–	–	–

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows differences in marginal effects (Year 2 minus Year 1) of an additional year of schooling on the probability of the outcome variable, evaluated at 4 and 8 years of schooling.

**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Table 10: Difference in Marginal Effects Asset Index, Year 2 - Year 1

	Knows that _ can prevent infection:				
Sample/Outcome:	**Condom**	**Abstinence**	**Limit Partners**	**Tested**	**Want to be Tested[a]**
Burkina Faso					
Women					
Rural	0.013	-0.020	0.003	–	–
Urban	0.008	0.002	-0.008	–	–
Men					
Rural	-0.158 **	0.029	-0.031	–	–
Urban	0.001	0.012	-0.059 *	–	–
Kenya					
Women					
Rural	-0.026	-0.036	-0.013	-0.006	-0.027
Urban	0.037	-0.002	0.027	-0.020	0.052
Men					
Rural	0.115 **	-0.030	-0.027	0.042	0.013
Urban	0.060	0.017	-0.025	0.035	0.110 *
Nigeria					
Women					
Rural	-0.010	0.003	0.064 *	–	–
Urban	-0.006	0.015	-0.022	–	–
Men					
Rural	-0.144 *	-0.014	-0.075	–	–
Urban	-0.139 **	0.011	0.029	–	–
Tanzania					
Women					
Rural	0.015	0.057 **	-0.066 **	-0.008	0.007
Urban	-0.014	0.007	-0.039 **	-0.013	-0.018
Men					
Rural	0.075	0.089 **	0.025	0.002	0.069
Urban	-0.051 **	-0.016	-0.024	-0.036	0.042
Uganda					
Women					
Rural	-0.005	0.005	0.042	-0.020	0.030
Urban	-0.014	0.033 **	-0.018	0.013	0.019
Men					
Rural	–	–	–	–	
Urban	–	–	–	–	
Zambia					
Women					
Rural	-0.031	0.063 *	0.005	–	–
Urban	0.020	0.008	0.011	–	–
Men					
Rural	0.107	0.053	-0.136	–	–
Urban	0.010	-0.071	-0.020	–	–

Note: based on probit estimates. Standard errors calculated using the delta method.
Shows differences in marginal effects (Year 2 minus Year 1).
**' denotes significance at the 5% level. '*' denotes significance at the 10% level.